BYCHKOV, V.P.

From the history of the development of the Jassy Mathematical School (Rumania). Vest. Mosk. un. Ser. 1: mat., mekh. 16 no. 1:66-78 Ja-F '61. (MIRA 14:3)

1. Kabinet istorii matematiki i mekhaniki Moskovskogo universiteta.
(Jassy, Rumania—Mathematics)

CHILIKIN, M.G.; TSELIKOV, A.I.; GOLOVAN, A.T.; PETROV, I.I.; BYCHKOV, V.P.; SOKOLOV, M.M.; DRUZHININ, N.N.; VESHENEVSKIY, S.N.; KHALIZEV, G.P.; TISHCHENKO, N.A.

D.P Morozov; obituary. Elektrichestvo no.5:93 My '63.
(MIRA 16:7)

(Morozov, Dmitrii Petrovich,)

BYCHKOV, V.P.

History of mathematics in Rumania; mathematics at the Jassy University. Trudy Inst. ist. est. i tekh. 43:290-350 '61.
(MIRA 15:1)

(Jassy, Rumania--Mathematics)

ANDRUNAKIYEVICH, V.A.; BYCHKOV, V.P.

Mathematics in the Moldavian S.S.R. Usp. mat. nauk 20 no.2:
247-258 Mr-Ap '65. (MIRA 18:5)

BYCHKOV, Vasiliy Pavlovich, kand. tekhn. nauk, dotsent; USYNIN, Yuriy Semenovich, aspirant

Modeling of the principal electric drives of a multishaft cold rolling mill. Izv. vys. ucheb. zav.; elektromekh. 8 no.11:1257-1265 '65. (MIRA 19:1)

1. Kafedra elektrooborudovaniya promyshlennykh predpriyatiy Moskovskogo ordena Lenina energeticheskogo instituta.

BYCHKOV, V.S.

Opening address. Biul. TSNIICHM no.18/19:5 '57. (MIRA 11:4)

1. Zamestitel' ministra chernoy metallurgii SSSR.
(Steel--Metallurgy)

BYCHKOV, V.S.; KHITSENKO, Yu.V.

Closing session May 18, 1957. Biul. TSNIICHM no.18/19:119-3 of cover '57. (MIRA 11:4)

1. Zamestitel' Ministra chernoy metallurgii SSSR (for Bychkov).
2. TSentral'nyy komitet Soyuza rabochikh chernoy metallurgii (for Khitsenko).

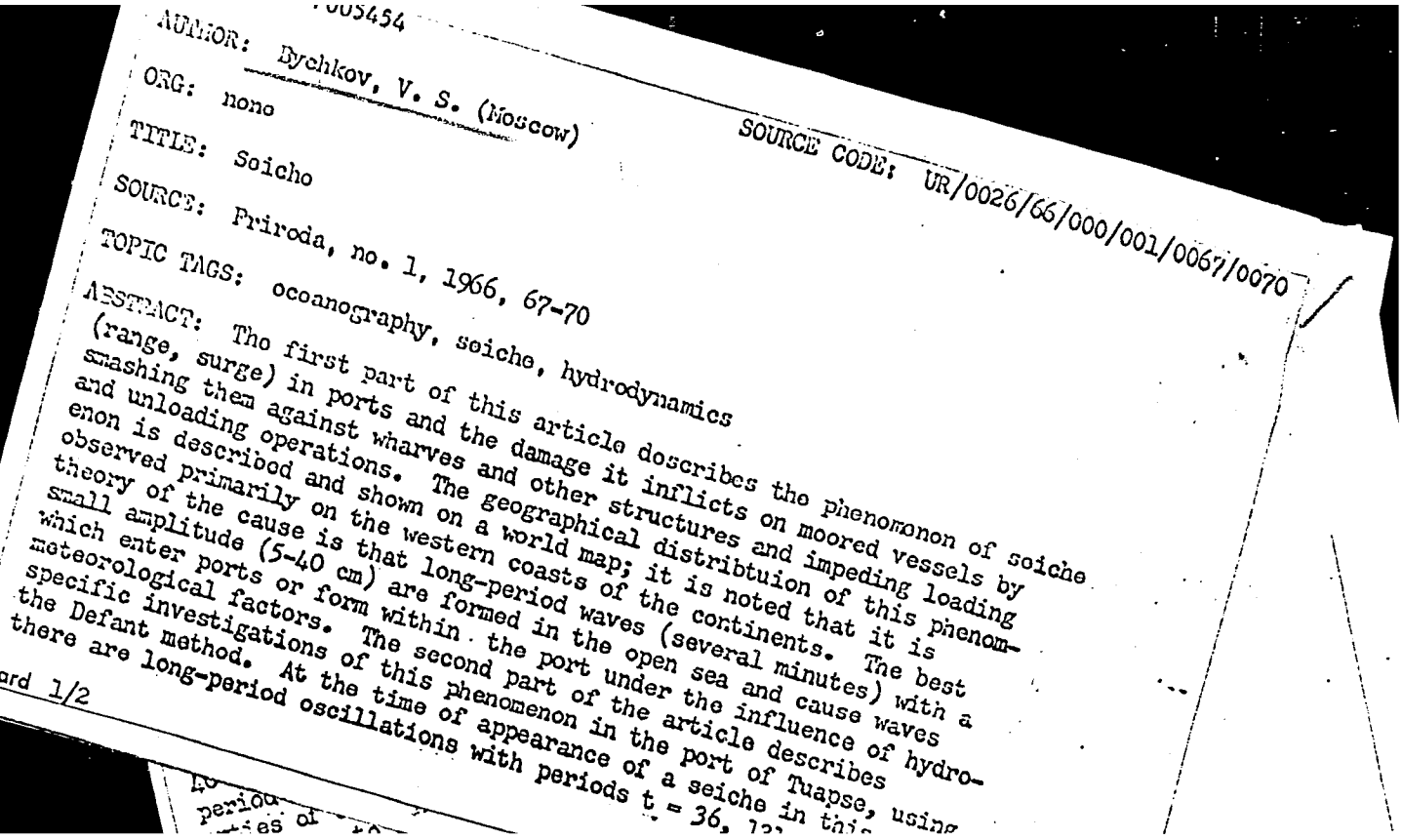
(Steel metallurgy)

SVATEYEV, Yu.I., inzh.; BYCHKOV, V.[illegible], inzh.

Some problems of field studies of high rock-fill dams. Trudy Lab. gidr.sooruzh. VODGEO no. 4:77-88 '63. (MIRA 17:6)

BYCHKOV, V.S. (Moskva)

"Seiching." Priroda 55 no.1:67-70 Ja '66. (MIRA 19:1)



005454

AUTHOR: Bychkov, V. S. (Moscow)

SOURCE CODE: UR/0026/66/000/001/0067/0070

ORG: none

TITLE: Soicho

SOURCE: Priroda, no. 1, 1966, 67-70

TOPIC TAGS: ocoanography, seiche, hydrodynamics

ABSTRACT: The first part of this article describes the phenomenon of seiche (range, surge) in ports and the damage it inflicts on moored vessels by smashing them against wharves and other structures and impeding loading and unloading operations. The geographical distribtuion of this phenomenon is described and shown on a world map; it is noted that it is observed primarily on the western coasts of the continents. The best theory of the cause is that long-period waves (several minutes) with a small amplitude (5-40 cm) are formed in the open sea and cause waves which enter ports or form within the port under the influence of hydrometeorological factors. The second part of the article describes specific investigations of this phenomenon in the port of Tuapse, using the Defant method. At the time of appearance of a seiche in this there are long-period oscillations with periods t = 36, 12

ard 1/2

ACC NR: AP7005454 SOURCE CODE: UR/0026/66/000/001/0067/0070

AUTHOR: Bychkov, V. S. (Moscow)

ORG: none

TITLE: Seicho

SOURCE: Priroda, no. 1, 1966, 67-70

TOPIC TAGS: ocoanography, seiche, hydrodynamics

ABSTRACT: The first part of this article doscribes the phenomonon of seiche (range, surge) in ports and the damage it inflicts on moored vessels by smashing them against wharves and other structures and impeding loading and unloading operations. The geographical distribtuion of this phenomenon is described and shown on a world map; it is noted that it is observed primarily on the western coasts of the continents. The best theory of the cause is that long-period waves (several minutes) with a small amplitude (5-40 cm) are formed in the open sea and cause waves which enter ports or form within the port under the influence of hydrometeorological factors. The second part of the article describes specific investigations of this phenomenon in the port of Tuapse, using the Defant method. At the time of appearance of a seiche in this port there are long-period oscillations with periods t = 36, 131, 267, 420

Card 1/2

UDC: 627.220.4

ACC NR: AP7005454

and 916 seconds (131 and 420 seconds are dominant). To determine the cause, simultaneous observations were made in the outer roadstead. It was found that simultaneously (or somewhat earlier) with the wind waves or swell the port of Tuapse is entered by long-period waves, invisible to the eye, with periods of 30 to 900 seconds and with a height of 5 to 40 cm and with a wavelength of 200-600 m. The character and dominant period of these waves is entirely dependent on the parameters and properties of the wind waves or swell present at the particular time at the approaches to the port. Orig. art. has: 2 figures and 1 table. [JPRS: 38,677]

SUB CODE: 08, 20 / SUBM DATE: none / ORIG REF: 001 / OTH REF: 002

Card 2/2

RAZUVAYEV, G.A.; VASILEYSKAYA, N.S.; BYCHKOV, V.T.; MAKAR'YEVA, A.Ye.

Photoreaction of carbon tetrachloride with dioxane. Zhur.ob.khim. 31 no.12:4057-4058 D '61. (MIRA 15:2)
(Carbon tetrachloride)
(Dioxane)

L 19603-65 EWT(m)/EPF(c)/EWP(j) Pc-4/Pr-4 AFWL/SSD/ASD(a)-5/ESD(gs) RM

ACCESSION NR: AP5003147 S/0020/64/158/002/0382/0384

AUTHOR: Vyazankin, N. S.; Razuvayev, G. A. (Correspondi g member AN SSSR); Bychkov, V. T.

TITLE: Bis-(triethylgermyl)-cadmium. Synthesis and properties

SOURCE: AN SSSR. Doklady, v. 158, no. 2, 1964, 382-384

TOPIC TAGS: organic synthetic process, cadmium compound, germanium compound, mercury compound, cadmium, germanium, mercury, organosilicon [illegible]

Abstract: In view of recently developed methods of producing bi- and polymetalloorganic compounds by reaction of diethylmercury with organogermanium and organosilicon hydrides, the authors attempted to extend the synthetic potentialities of this reaction by replacing diethylmercury with its structural analogs. Triethylgermanium reacted with diethylcadmium under mild conditions, forming bis-(triethylgermyl)-cadmium and ethane in yields of 78.6 and 90.3%, respectively. Bis-(triethylgermyl)-cadmium is a lemon-yellow nonvolatile liquid, which cannot be islated in the pure state. When heated in an evacuated ampoule to 125-130°, it decomposed, forming metallic cadmium and hexaethyldigermane in high yields. Bis-(triethylgermyl) -cadmium is oxidized vigorously by atmospheric oxygen, yielding bis-triethyl-

Card 1/2

L 19603-65
ACCESSION NR: AP5003147

germanium oxide and cadmium. The reactions of bis-(triethylgermyl)-cadmium and its mercury analog with benzoyl peroxide differ appreciably, the former reacting with two moles of the peroxide to form benzoyoxytriethylgermane and cadmium dibenzoate. The latter, reacting with an equimolar amount of the peroxide, results in the isolation of mercury in pure form. The greater ease of the reactions of the cadmium compound in comparison with its mercury analog was demonstrated for reactions with alkyl bromides and hydrolysis by water. Bis-(diethylgermyl)-cadmium undergoes an exothermal reaction with 1,2-dibromoethane, yielding cadmium bromide, ethylene and triethylbromogermane. Orig. art. has 5 formulas.

ASSOCIATION: none

SUBMITTED: 14May64 ENCL: 00 SUB CODE: OC, GC

NO REF SOV: 003 OTHER: 002 JPRS

Card 2/2

L 26943-65 EWT(m)/EPF(c)/EWP(j)/EWP(t)/EWP(b) Pc-4/Pr-4 IJP(c) RM/JD

ACCESSION NR: AP5005557 S/0079/65/035/002/0395/0396

AUTHOR: Vyazankin, N. S.; Razuvayev, G. A.; Bychkov, V. T.

TITLE: Bis-(triethylsilyl)cadmium

SOURCE: Zhurnal obshchey khimii, v. 35, no. 2, 1965, 395-396

TOPIC TAGS: organometallic compound, bis (triethylsilyl)cadmium, chemical property, organoelemental compound

ABSTRACT: An organometallic compound with Si-Cd bond, bis-(triethylsilyl)cadmium(I), has been prepared by reacting triethylsilane with diethylcadmium at 110C in evacuated and sealed ampuls. The compound is a yellow liquid readily oxidized in air. Its structure was confirmed by analyzing the products of the reactions of I with bromine in CCl_4, I with benzoylperoxide in benzene, and decomposition at 140C. The reactions of I and its analog bis-(triethylgermyl)cadmium with ethyl bromide gave different products. Orig. art. has: 2 formulas. [JK]

ASSOCIATION: Laboratoriya stabilizatsii polimerov Akademii nauk SSSR, Gor'kiy (Laboratory of Polymer Stabilization, Academy of Sciences, SSSR)

Card 1/2

L 26943-65

ACCESSION NR: AP5005557

SUBMITTED: 22Jun64 ENCL: 00 SUB CODE: OC, GC

NO REF SOV: 001 OTHER: 001 ATD PRESS: 3189

Card 2/2

VYAZANKIN, N.S.; BYCHKOV, V.T.

Certain reactions of organotin hydrides. Zhur. ob. khim. 35 no.4: 684-687 Ap '65.

Reactions of dibutyltin with alkyl halides. Ibid.:687-689
(MIRA 18:5)

1. Gor'kovskiy gosudarstvennyy universitet imeni N.I. Lobachevskogo.

L 5061-66 EWT(m)/EPF(c)/EWP(j)/T/EWA(c) RM

ACCESSION NR: AP5025511 UR/0062/65/000/009/1665/1667
542.91+547.17

44,55 44,55 44,55

36
33
B

AUTHOR: Vyazankin, N. S.; Razuvayev, G. A; Bychkov, V. T.

TITLE: New reactions of bis(triethylgermyl)cadmium 44,55

SOURCE: AN SSSR. Izvestiya. Seriya khimicheskaya, no. 9, 1965, 1665-1667

TOPIC TAGS: organogermanium compound, organocadmium compound, organomercury compound, organotin compound, organosilicon compound

ABSTRACT: Bis(triethylgermyl)cadmium (I) was synthesized by reacting triethylgermane with diethylcadmium. Reaction of (I) with acetic acid gave triethylacetoxygermane; with n-propyl alcohol, triethylgermane and triethylpropoxygermane were produced; with triethyltin hydride, triethylgermane and hexaethyldistannane were obtained. Reaction of (I) with triethyltin gave triethylgermane; with mercuric chloride, triethylchlorogermane; and with mercury, bis(triethylgermyl)mercury. From bis(triethylsilyl)cadmium and mercury, bis (triethylsilyl)mercury was obtained, and the reaction of diethylcadmium with mercury yielded diethylmercury.

Card 1/2

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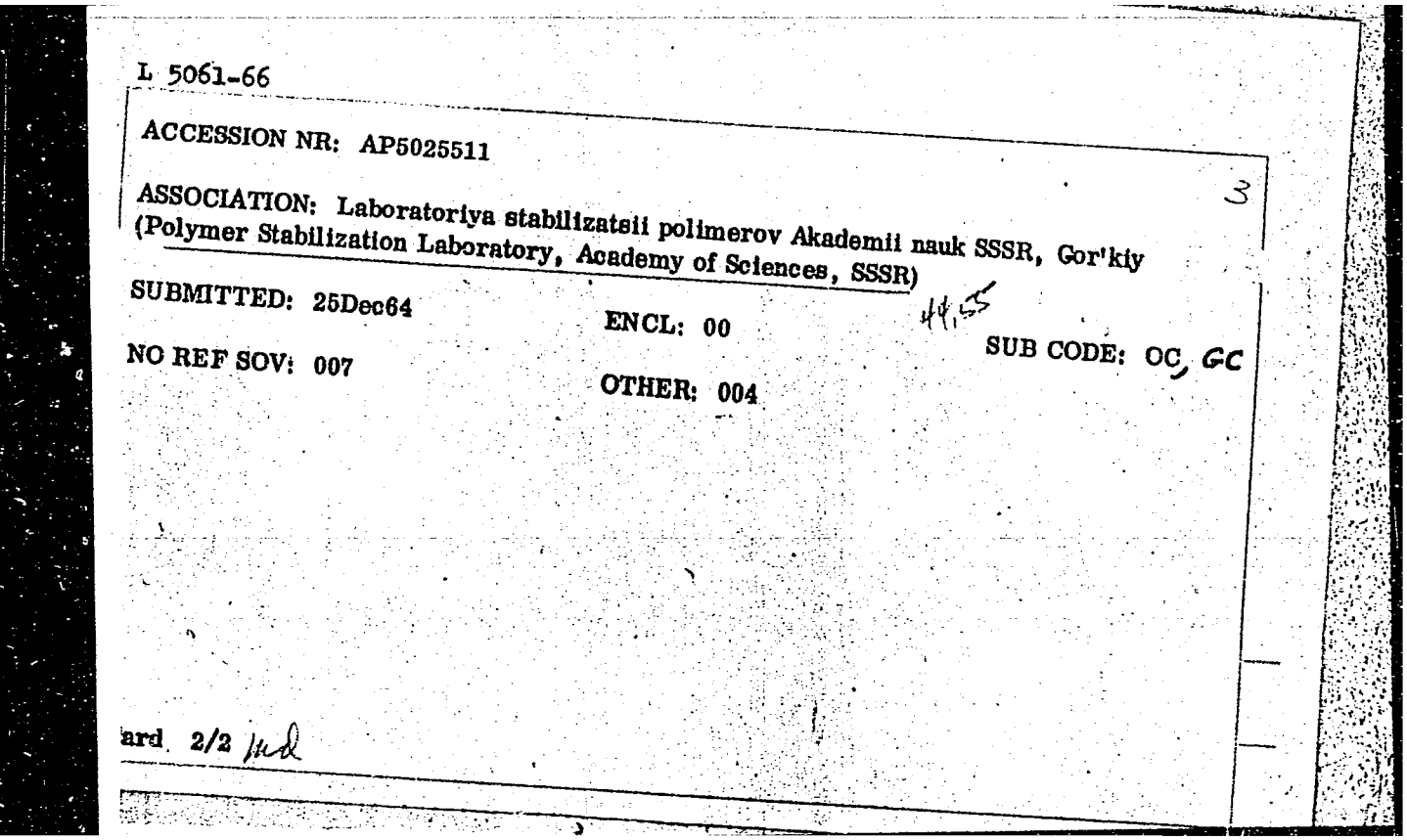

L 5061-66

ACCESSION NR: AP5025511

ASSOCIATION: Laboratoriya stabilizatsii polimerov Akademii nauk SSSR, Gor'kiy (Polymer Stabilization Laboratory, Academy of Sciences, SSSR)

SUBMITTED: 25Dec64 ENCL: 00 SUB CODE: OC, GC

NO REF SOV: 007 OTHER: 004

ard 2/2

L 31880-66 EWT(m)/ETC(f)/EWP(j)/T DS/WW/RM

ACC NR: AP6012534 SOURCE CODE: UR/0062/66/000/003/0562/0564

AUTHOR: Vyazankin, N. S.; Razuvayev, G. A.; Bychkov, V. T.; Zvezdin, V. L. 33

ORG: Laboratory for Stabilization of Polymers, Academy of Sciences SSSR (Laboratoriya stabilizatsii polimerov Akademii nauk SSSR) B

TITLE: Reactions of bis(triethylgermyl) cadmium

SOURCE: AN SSSR. Izvestiya. Seriya khimicheskaya, no. 3, 1966, 562-564

TOPIC TAGS: organic synthesis, cadmium compound

ABSTRACT: Two types of reactions are known for the bimetal organic compound, containing Ge-Me bond with monobromo derivatives

$$(R_3Ge)_n M + n\,R'Br \begin{cases} \rightarrow n\,R_3GeBr + R'_n M & (1) \\ \rightarrow n\,R_3GeR' + MBr_n & (2) \end{cases}$$

Equation (1) is followed in photoreaction of bis(triethylgermyl)-mercury and tris (triethylgermyl)-antimony under the action of heat. Reaction (2) is characteristic for triethylgermyl potassium, triphenylgermyl lithium and related compounds.

Card 1/2 UDC: 547.1'3 + 541.14

L 31880-66

ACC NR: AP6012534

Bis(triethylgermyl)-cadmium reacts in the same manner with alkyl bromide. Continuing the work in this field the authors found that bromobenzene (in contrast to alkyl-bromides) does not react with bis(triethylgermyl)-cadmium even where the latter decomposes into hexaethyldigermane and metallic cadmium. On the contrary, the photochemical reaction (1) proceeds very easily under ultraviolet light with bromobenzene, and produces triethylbromogermane, triethylphenylgermane, diphenyl cadmium and cadmium bromide. It was found that bis(triethylgermyl)-cadmium and bis(triethylgermyl)-mercury react with Li(Na) in tetrahydrofurane with the formation of triethylgermyl lithium (sodium) derivative.

SUB CODE: 07/ SUBM DATE: 23Jul65/ ORIG REF: 004/ OTH REF: 007

Card 2/2

1. Bychkov, V.V.

S/137/60/000/005/002/009
A006/A002

Translation from: Referativnyy zhurnal, Metallurgiya, 1960, No. 5, p.173, # 10402

AUTHOR: Bychkov, V.V.

TITLE: Experiences Made in the Assimilation of Automatic and Semi-Automatic Welding Under a Flux Layer Into the "Uzbekkhimmash" Plant

PERIODICAL: Prom-st' Tashkentsk. sovnarkhoza, 1958, No. 2, pp. 30-32

TEXT: Automatic welding under flux is used at the Plant for the manufacture of cylindrical containers (chemical equipment). In two-sided welding low-carbon steel containers (wall thickness 6-16 mm), a "balcony-type" welding machine is used that is equipped with a roller positioner. The internal welds are made with a "TC-17M" (TS-17-M) tractor (annular seams on an asbestos band; longitudinal seams on a flux pad). The external joints are welded with a "АДС-1000-3" (ADS-1000-3) head. "АН-348-А" (AN-348-A) flux and the "Св-08А" (Sv-08A) welding wire are used. Alternating current ["ТДС-1000" (TDS-1000)] and direct current ["ПСМ-1000" (PSM-1000)] for thin metals, are employed. Welding conditions for 6; 12; 16 mm thickness are, respectively: 600-650, 900-950, 1000-1200 amps current; 36-38, 38-40, 40-43 v arc voltage; 47, 27, 23 m/h welding speed. Flanges to

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S/137/60/000/005/002/009
A006/A002

Experiences Made in the Assimilation of Automatic and Semi-Automatic Welding Under a Flux Layer Into the "Uzbekkhimmash" Plant

connecting pipes and bottoms are welded on manipulators with "АБ" (AB) or "ПШ-5" (PSh-5) heads, mounted on revolvable brackets. Automatic welding of stainless "18-8" grade steel is carried out under ceramic "ХНК-66" (KhNK-66) flux (developed by the Khar'kov NIIKhIMMASh Branch) with "СВ0Х18Н9" (SV0Kh18N9) for "1Х18Н9Т" (1Kh18N9T) or "Х18Н11М" (Kh18N11M) wire for "Х18Н12М2Т" (Kh18N12M2T) and "Х18Н12М3Т" (Kh18N12M3T). Welding was performed on the same equipment. The welding conditions for 6, 12, 16 mm thickness are: 500 to 550, 800 to 850, 1000 to 1100 amps current; 36 to 38, 38 to 40, 40 to 45 v arc voltage; 43, 25, 18 m/h welding speed. Presently, automatic and semi-automatic welding has replaced manual welding to 40-45%.

V. T.

Card 2/2

25824
S/142/60/003/006/015/016
E192/E382

6.4300

AUTHOR: Bychkov, V.Yu.

TITLE: The Use of Ferrite Valves in a Phasemeter for Centimetre Waves

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiotekhnika, 1960, Vol. 3, No. 6, pp. 665 - 667

TEXT: One of the deficiencies of a bridge-type phasemeter for centimetre waves is the fact that its accuracy is greatly dependent on the ratio of the powers of the measured and the standard signals. In the following, a phsemeter is described where the influence of the above factor on the accuracy is largely eliminated due to the use of ferrite valves. The block diagram of such a phasemeter is shown in Fig. 1. The system consists of: 1 - standard generator; 2 - junction; 3 - 3' - ferrite valves; 4 - investigated phase-shifter; 5 - standard phase-shifter; 6 - slot-type bridge; 7 - detector circuits. The cause of the errors in this system is due to the fact that when the levels of the measured and

the standard signals are changed, the detectors 7 become mismatched since their equivalent resistant at UHF depends on their input power. This mismatch results in a change between the phases of the incident waves in the output arms of the waveguide bridge 6 and the junction 2 . In general, the junction can be represented in the form of an equivalent six-pole, the standard and the measured signals being connected to its output terminals (ports). This six-pole is characterised by a scattering matrix $\| S_{ik} \|$ (Ref. 4 - Theory of Transmission Lines of UHF, Izd-vo Sovetskoye radio, 1951)

which relates the incident fields (a_1, a_2, a_3) and the reflected waves (b_1, b_2, b_3), the relationship being expressed by:

$$b_i = \sum_{K=1}^{3} S_{iK} a_K , \quad (i = 1,2,3) \qquad (1) ,$$

The components S_{ik} are complex quantities. The ratio of the standard and the measured signals can be expressed as:

$$\frac{b_2}{b_3} = \frac{S_{21} + (S_{23}S_{31} - S_{21}S_{33})p_3}{S_{31} + (S_{32}S_{21} - S_{31}S_{22})p_2} \qquad (2)$$

where p_2 and p_3 represent the reflection coefficients for the waves in the channels of the standard and the measured signals, respectively. It is seen, therefore, that if the reflection coefficients are finite, the ratio b_2/b_3 is dependent on them. The errors due to this effect can be eliminated if the values of the reflection coefficients are fixed. This can be achieved by including in the system four ferrite valves, as is shown in Fig. 1. If the phase-shifters and the bridge are well matched, it is sufficient to employ only two valves, 3' , which are connected to the input of the

detectors. The error suppression by means of the ferrite valves was investigated experimentally, only the valves 3' being used. The experimental results are illustrated in Fig. 2, which shows the change of the power (indicated by the circles in the graph) and phase (dots in the graph) of the standard signal, while the probe of the measuring line is displaced. From the figure it is seen that the phase remains constant while the level of the measured signal is changed by about 10 db. The phase in the system is measured by determining the zero difference between the detector currents. In the case of ideal matching, the difference current becomes nil periodically when the phase-shift between the measured and the standard signals is 180°. However, the experiment showed a deviation from this periodic change which can be explained by the fact that the detectors are not identical.

There are 3 figures and 4 references: 1 Soviet and 3 non-Soviet. The three English-language references quoted are: Ref. 1 - W.A. Cumming - PIRE, 1959, 47, No. 5, 707; Ref. 2 - R.M. Barret and M.M. Barnes - Electronics, 1952, Vol. 25, No. 1, 120; Ref. 3 - E.B. Mullen and E.R. Carlson - PIRE, 1956, 44, No. 10, 1318.

ASSOCIATION: NIRFI pri Gor'kovskom gos. universitete im. N.I. Lobachevskogo (NIRFI of Gor'kiy State University im. N.I. Lobachevskiy)

SUBMITTED: May 4, 1960 (initially)
June 23, 1960 (after revision)

Card 5/6

TIMOFEYEVA, V.A.; BYCHKOV, V.Z.

Growing potassium niobate crystals from a solution in a potassium carbonate melt on seed crystals. Rost krist. 4: 140-143 '64. (MIRA 17:8)

BYCHKOV, Ye.I., inzh.

The P-630 press. Stroi.i dor.mashinostr. 5 no.7:27 Jl '60.
(MIRA 13:7)

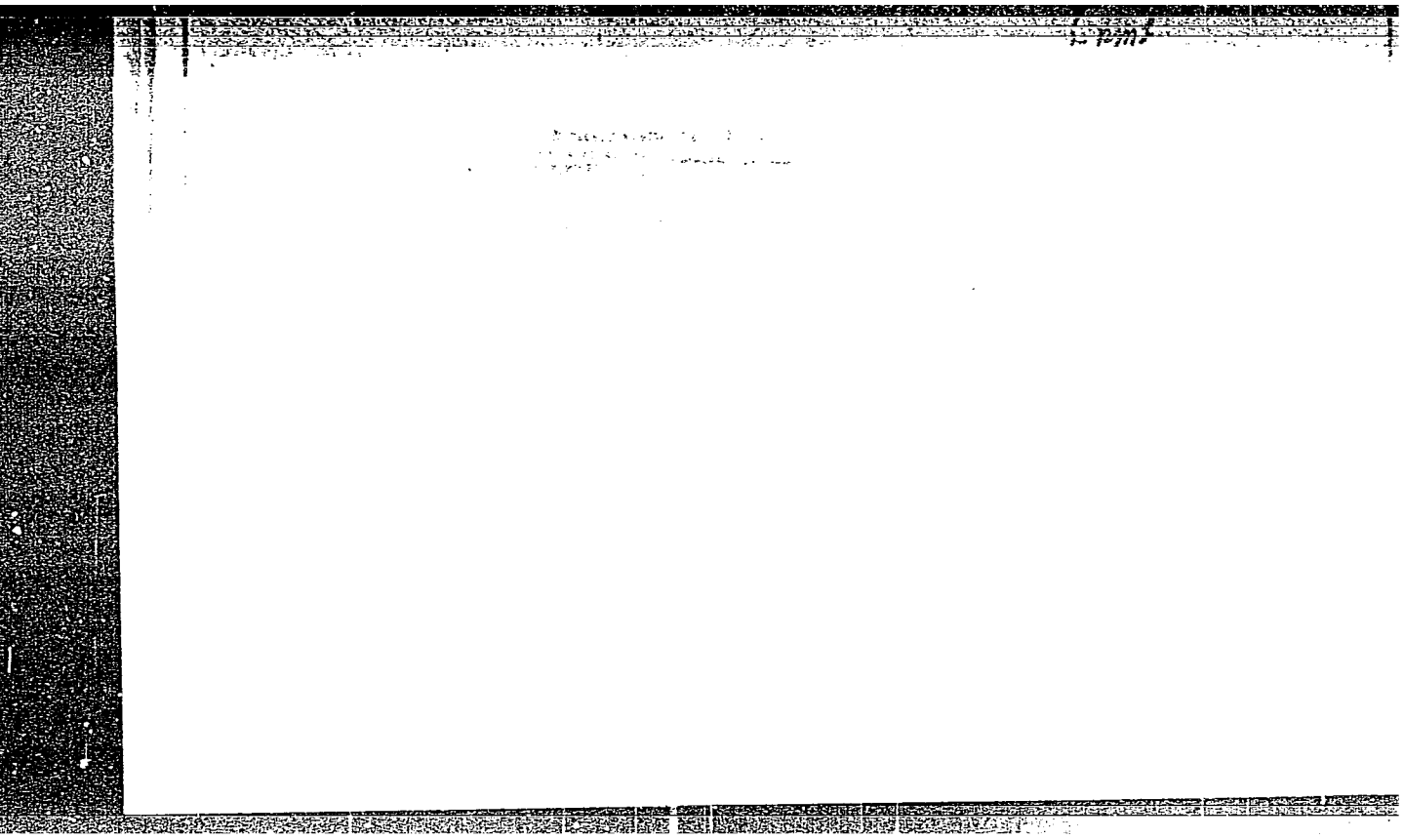
(Hydraulic presses)

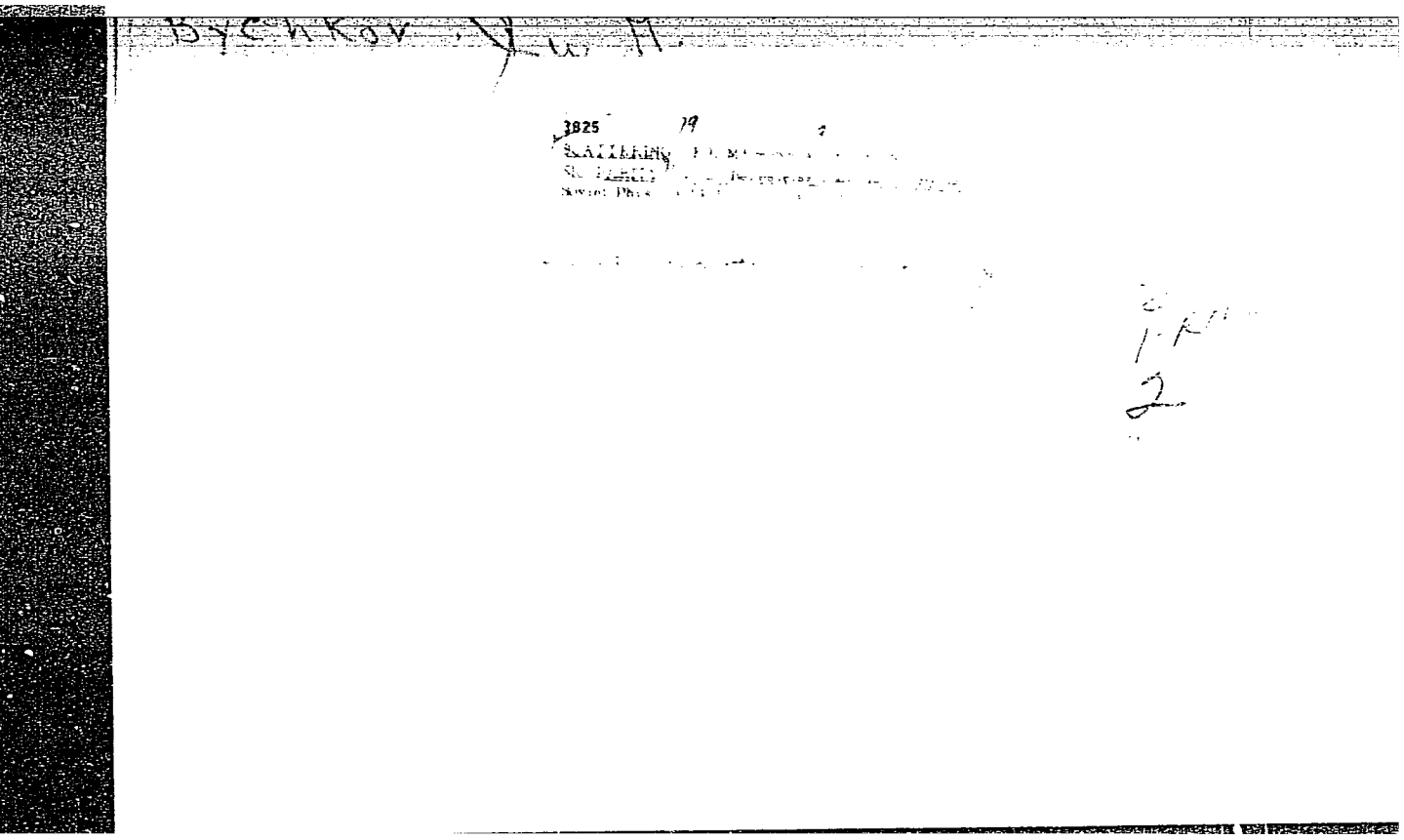
BYCHKOV, Yu., kapitan dal'nego plavaniya

Method of rigging loading booms. Mor. flot 21 no.9:14 S '61.
(MIRA 14:9)

1. Starshiy shturman parokhoda "Sakko" Dal'nevostochnogo parokhodstva.

(Cargo handling)





BYCHKOV, Yu.A.

AUTHOR BERESTECKIJ, V.B., BYČKOV, JU.A. PA - 2088

TITLE Scattering of K-Mesons with Change of Intrinsic Parity (Rassejanie K-mesonov s izmenieniem vnutrennej četnosti).

PERIODICAL Zhurnal Eksperimental'noi i Teoret. Fiziki, 1957, Vol 32, Nr 1, pp 181-183 (U.S.S.R.)

Received 3/1957 Reviewed 4/1957

ABSTRACT Analysis of experimental data on the decay of K-mesons (various relevant works are mentioned) leads with high probability to the following conclusions. 1) The spin of K-mesons is equal to zero. 2) K-mesons may occur in states of different internal symmetry, i.e. with positive (θ-mesons) and with negative (τ-mesons) symmetry. On the occasion of a collision between K-mesons and nucleons, the internal symmetry of K-mesons may change. (Transformation of θ-mesons into τ-mesons and vice versa) For the purpose of the investigation of some general properties of such a process, the authors form the wave function of the ΨK-meson-nucleon-system in the form of a total of two spinors Ψ_θ and Ψ_τ (which transform in different way on the occasion of reflection). $\Psi = \begin{pmatrix}\Psi_\theta \\ \Psi_\tau\end{pmatrix}$, $I\Psi_\theta = \Psi_\theta$, $I\Psi_\tau = -\Psi_\tau$. Here I denotes the reflection operator. In the scattering problem Ψ has the following usual form $\Psi = u \exp(ik\vec{n}_0\vec{r}) + F(\vec{n})e^{ikr}/r$. Here $\vec{n}_0$ and $\vec{n}$ denote the unit-vectors of the inciding and scattered wave, i and F the corresponding amplitudes, which, similar to Ψ are bispinorial quantities. If the properties of interaction between θ- and τ-mesons and the nucleons are equal, this equality also holds good for the "symmetrically conjugated" amplitudes. The amplitude F in the above equation can be written down as $F = Ru$, in this connection R denotes a twodimensional matrix (Each of its

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Scattering of K-Mesons with Change of Intrinsic Parity.

elements consists of a twodimensional matrix with respect to spin variables) The matrix R can be represented in the form of $R = a + bC_p$, where a denotes a scalar and b a pseudoscalar. Amplitude au describes the usual scattering (without transformation of internal symmetry) and has the form which is usual in the theory of the scattering of spinor waves. However, the authors also wish to ascertain the general form of the amplitude bu which describes the scattering with modification of internal symmetry.
For this purpose the relation between the inciding and diverging wave is studied with certain values of momenta and of symmetry. This relation is explicitly written down and discussed. In the case of small momenta the term $j = 1/2$ corresponding to the transitions $s_1/a \rightleftarrows p_1/a$ will suffice. From the expression obtained for b it follows that, in the case of such a scattering, nucleons are not polarized. The considerations discussed here hold good also for the scattering of $\Sigma-$ and Λ-particles by nuclei with the spin zero, if the spin of these particles is equal to 1/2. These considerations also hold good for the processes $K + N \rightarrow \Sigma + \pi$ and $K + N \rightarrow \Lambda + \pi$.

ASSOCIATION Not given
PRESENTED BY
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Card 2/2

24(3) SOV/56-37-2-30/56

AUTHORS: Bychkov, Yu. A., Gurevich, L. E., Nedlin, G. M.

TITLE: Thermoelectric Phenomena in Strong Magnetic Fields in Metals With Different Fermi Surfaces

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 2(8), pp 534-539 (USSR)

ABSTRACT: This is an accurate investigation of several thermoelectric phenomena on the basis of the quasiclassical theory of the kinetic phenomena in metals placed in strong magnetic fields developed by I. M. Lifshits, M. Ya. Azbel' and M. I. Kaganov. If an electric field and a temperature gradient exist in the metal, the distribution function f of the particles is no longer given by $f_0 = \left\{\exp\left[(\varepsilon - \mu)/kT\right] + 1\right\}^{-1}$, but it differs from f_0 by a certain quantity f_1, i.e. $f = f_0 + f_1$ is a solution of the corresponding kinetic equation. The existence of the additional term f_1 causes the current density vector $\vec{j}$ and the thermal flux vector $\vec{q}$ to differ from zero. They are related to f_1 by the following expressions:

Card 1/4

Thermoelectric Phenomena in Strong Magnetic Fields in Metals With Different Fermi Surfaces

$\vec{j} = \frac{2e}{(2\pi\hbar)^3}\int \vec{v} f_1 dp$, $\vec{q} = \frac{2}{(2\pi\hbar)^3}\int (\varepsilon - \zeta)\vec{v} f_1 dp$. In the general case $\vec{j}$ and $\vec{q}$ may be written as follows:

$$j_i = \frac{a_{ik}}{T} E_k + b_{ik} \frac{\partial}{\partial x_k}\left(\frac{1}{T}\right), \quad q_i = \frac{c_{ik}}{T} E_k + d_{ik} \frac{\partial}{\partial x_k}\left(\frac{1}{T}\right).$$

In the presence of a magnetic field the kinetic coefficients are functions of the vector $\vec{H}$. The asymptotic behavior of a thermoelectromotive force in a strong magnetic field is studied. If the dependence of the α_{ik} upon $\vec{H}$ is known, it is easy to obtain the asymptotic characteristics β_{ik} and μ_{ik} by applying the symmetry relations. Actually, the asymptotic characteristics of the Peltier-coefficients are everywhere determined first. In the first section of this article the case of a closed Fermi surface is discussed. In order to determine the dependence of the tensor β_{ik} upon the magnetic field strength, the

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behavior of the quantities a_{ik} and c_{ik} must be known. The authors make recourse extensively to the results of the papers by I. M. Lifshits and V. G. Peschanskiy (Ref 2). In this section the following two possibilities are investigated: a) The number of particles and holes is not equal. b) These numbers are equal. Explicit expressions for the tensor β_{ik} are derived for both cases. In the second section the case of a closed Fermi surface is investigated. The behavior of the thermoelectric coefficients near the following special directions of the magnetic field is studied: a) The magnetic field is so directed that a layer of open trajectories exists forming a unidimensional set; b) The directions of the magnetic field forming open trajectories constitute a two-dimensional domain; c) The vector has a distinguished direction in the domain of the open trajectories, if the trajectories are closed. The tensors a_{ik}, c_{ik} and β_{ik} are written down explicitly. By this method the character of the asymptotic behavior of the thermoelectric coefficients near all three kinds of

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singularities have been determined. The authors express their gratitude to Academician L. D. Landau for discussing the work, Yu. A. Bychkov also expresses his gratitude to I. M. Khalatnikov and I. M. Lifshits for valuable discussions. There are 4 Soviet references.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems of the Academy of Sciences, USSR)
Leningradskiy fiziko-tekhnicheskiy institut Akademii nauk SSSR (Leningrad Physical and Technical Institute of the Academy of Sciences, USSR)

SUBMITTED: March 19, 1959

83768

S/056/60/039/003/022/045
B006/B063

24.7600

AUTHOR: Bychkov, Yu. A.

TITLE: The Quantum Theory of the Electrical Conductivity of Metals in Strong Magnetic Fields

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 3(9), pp. 689-702

TEXT: The aim of the present work was a quantum-mechanical treatment of galvanomagnetic phenomena appearing in strong magnetic fields at very low temperatures. The author proceeded from the simplifying assumption of the mean free time of the electron being very long as compared to its period of revolution in the magnetic field. I. M. Lifshits et al. have worked out a quasi-classical theory of galvanomagnetic effects occurring in metals in strong magnetic fields, taking into account the complex character of the dispersion law for elementary excitations. The quantum corrections to the resistivity tensor (Shubnikov - de Haas effect) have been calculated by other authors. The results obtained by the various researchers are, however, contradictory. In the present paper, the author

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derived expressions for the conductivity tensor σ_{ik} for metals of low carrier concentrations. In this case, the dispersion law may be assumed to be almost quadratic, and the isoenergetic surface can decompose into several non-intersecting ellipsoids. Bismuth is a typical example of such metals. One of the main problems is taking account of the specific character of the scattering of electrons by impurities in the presence of strong magnetic fields. First, the author studies the motion of a free electron in a strong magnetic field when assuming the dispersion law $\varepsilon = (1/2)\mu_{ik}p_ip_k$. Only thereupon, the scattering of an electron situated in a magnetic field by impurities is examined. The important fact when determining the scattering amplitude is that the electron wavelength in metals of low carrier concentrations is large compared to the range of action of the potential. This simplifies calculations considerably. For a potential having the form $U(r) = f\delta(\vec{r})$, where f is the scattering amplitude of an electron of zero energy, an expression is obtained for the amplitude F_{mn} of the transition from the state n into the state m. In the following section, the author examines the dependence of the electrical

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The Quantum Theory of the Electrical Conductivity of Metals in Strong Magnetic Fields

conductivity on the magnetic field for $1/\omega\tau \ll 1$. The mean distance between the impurities distributed at random is large compared to the electron wavelength and the scattering amplitude. As a result, the waves scattered from the various impurities do not interfere. Several relations are derived for the scattering of electrons by these impurities. The author thanks L. D. Landau and I. M. Khalatnikov for discussions. B. I. Davydov, I. Ya. Pomeranchuk, and V. G. Skobov are mentioned. There are 8 references: 6 Soviet and 2 US.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems of the Academy of Sciences USSR)

SUBMITTED: April 8, 1960

86916

S/056/60/039/005/033/051
B006/B077

24.4500

AUTHOR: Bychkov, Yu. A.

TITLE: The Influence of Impurities on the de Haas - van Alphen Effect

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1401 - 1410

TEXT: The influence of elastic scattering of electrons from impurities upon the quantum oscillations of the magnetic susceptibility $\chi(H)$ of the electron gas in metals (de Haas - van Alphen effect) is investigated by employing the quantum field theory as proposed by Edwards and A. A. Abrikosov and L. P. Gor'kov. In order to determine the magnetic moment of the system it is necessary to know the free energy F, which is for elastic collisions

$$F = N\zeta - 2kT \int_0^\infty \frac{dZ}{d\varepsilon} \ln\left(1 + \exp\left(\frac{\zeta - \varepsilon}{kT}\right)\right) d\varepsilon,$$ where ζ denotes the chemical poten-

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The Influence of Impurities on the de Haas - van Alphen Effect

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tial, N the number of electrons per unit volume, and $dZ/d\varepsilon$ the density of the electron states per unit of energy interval in the presence of a magnetic field H and randomly distributed impurities; factor 2 is connected with the electron spin. The problem consists mainly in the calculation of the state density $dZ/d\varepsilon$. The quasi classical case is studied where $\hbar\omega/\zeta \ll 1$ ($\omega = eH/m$, the frequency of rotations of the electron in the field H), the law of dispersion is assumed to be quadratic ($\varepsilon = \vec{p}^2/2m$) and $\varepsilon = \omega(M_o+1/2) + \Delta$, $|\Delta| \leq \omega/2$; $dZ/d\varepsilon$ tends at $\Delta \to -0$ towards a finite value and at $\Delta \to +0$ towards infinity, that is if the scattering through impurities is neglected; $dZ/d\varepsilon$ is a steady function if $\Delta \neq 0$. It is shown if $1/\omega\tau_o \ll \hbar\omega/\zeta$ the scattering on impurities can be described as the Dingle's factor $\tau_D = 4\pi/\tau_o$ (τ_o is the mean free path for H=0). For $1/\omega\tau_o \simeq \hbar\omega/\zeta$ the calculations are much more complicated. For $\zeta = \hbar\omega(N+1/2) + \Delta$, $|\Delta| \leq \hbar\omega/2$, the effect of impurities can still be described by Dingle's factor if $\hbar^2\omega^2/\zeta \ll |\Delta| \lesssim \hbar\omega/2$. In the range $|\Delta| \simeq \hbar^2\omega^2/\zeta$ the influence of impurities is very complicated. Explicit

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The Influence of Impurities on the de Haas - van Alphen Effect

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formulas are given for the oscillating magnetic moment M_2 and the oscillating portion of the susceptibility χ_2 ($\chi = \chi_1 + \chi_2$). The author thanks Academician L. D. Landau, A. A. Abrikosov, L. P. Gor'kov, and I. M. Khalatnikov for their suggestions and discussions. There are 3 figures and 6 references: 3 Soviet, 1 US, 1 British, and 1 German.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems of the Academy of Sciences USSR)

SUBMITTED: June 22, 1960

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BYCHKOV, Yu.A., Cand Phys-Math Sci -- (diss) "Some problems in the theory of metals under strong magnetic fields." Moscow, 1960. 11 pp; (Academy of Sciences USSR, Inst of Physical Problems); 220 copies; free; bibliography at end of text (17 entries); (KL, 51-60, 115)

26710
S/056/61/041/005/025/038
B102/B138

24,2200 (1018, 1121, 1137)

AUTHORS: Bychkov, Yu. A., Gor'kov, L. P.

TITLE: Quantum oscillations of the thermodynamic quantities of a metal in a magnetic field according to the Fermi fluid model

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 5(11), 1961, 1592-1605

TEXT: L. D. Landau's theory of the Fermi fluid (ZhETF, 30, 1058, 1956; ibid. 35, 97, 1958) is applied to investigate the de Haas-van Alphen effect for the electrons in a metal. The Fermi fluid is assumed to be isotropic and the long-range part of the Coulomb interaction to be screened. To determine the energy spectrum of the electrons, the authors start from an investigation of the properties of the Green functions of electrons in a magnetic field:

$$G(\mathbf{r}, \mathbf{r}'; t - t')\,\delta_{\alpha\beta} = -i\langle T(\psi_\alpha(\mathbf{r}, t)\,\psi_\beta^+(\mathbf{r}', t'))\rangle. \qquad (1)$$

The field operators $\psi_\alpha(x)$ and $\psi_\beta^+(x')$ include field dependence. In the

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following, the Fourier components $G(\vec{r}, \vec{r}'; \varepsilon)$ of (1) through the time difference $(t-t')$ are considered in the Dyson equation

$$\left[\varepsilon+\mu-\frac{1}{2m}\left(\hat{p}-\frac{e}{c}A\right)^2\right]G(r, r'; \varepsilon)-\int\Sigma(r, r''; \varepsilon)\,G(r'', r'; \varepsilon)\,d^3r''= \\ =\delta(r-r'). \qquad (6)$$

$\hat{\vec{p}} = -i\partial/\partial r$, μ - chemical potential of the electrons in the magnetic field, $\sum(\vec{r},\vec{r}''; \varepsilon)$ is the so-called self-energy part, caused by particle interaction in the Fermi fluid. The vector potential is defined by $\vec{A}(\vec{r}) = \{-Hy,0,0\}$. For small ε and H=0 the function $G^0(\vec{p}, \varepsilon)$ has a pole near the Fermi surface: $G^0(\vec{p}\,\varepsilon, = a/(\varepsilon-v(p-p_0) + i\delta(\varepsilon))$. The spectrum of the Fermi fluid is defined by $\varepsilon = v(p-p_0)$, i.e. from the eigenvalues of the operator which stands within the brackets of (6). The electron interaction Hamiltonian in secondary-quantization representation is given by

$$\hat{H}_{int}=\int\psi^+(r')\left[\frac{e}{2mc}(\hat{p}-\hat{p}')_x+\frac{e^2Hy}{2mc^2}\right]Hy\psi(r)\,d^3r, \qquad (7)$$

$\hat{p}_x = -i\partial/\partial x$. The authors show that the electron energy spectrum in the magnetic field can be determined from (5) with regular quasiclassical

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quantization, as proposed by I. M. Lifshits and A. M. Kosevich (ZhETF, 29, 780, 1955). Where the electrons are near the Fermi surface as in the de Haas-van Alphen effect

$$G(\mathbf{p}, \mathbf{p}'; \varepsilon) = \sum_n \psi_n(\mathbf{p})\psi_n^*(\mathbf{p}')\,\delta(p_x - p_x')\,\delta(p_z - p_z')\,G_n(p_z, \varepsilon),$$

$$G_n(p_z, \varepsilon) = a/(\varepsilon + p_0^2/2m^* - (n + 1/2)\omega^* - p_z^2/2m^* + i\delta(\varepsilon)), \quad (15)$$

is found, with $\omega^* = eH/m^*c$; the constants a, m^* and p_0 contain terms which are functions of $H^{3/2}$. The singularity near the Fermi surface is determined by $G^0(\vec{p}, \varepsilon) = \frac{a}{\varepsilon - v(p-p_0) + i\delta(\varepsilon)} + g(\vec{p}, \varepsilon)$. The Green function in coordinate representation is given by

$$G(\mathbf{r}, \mathbf{r}'; \varepsilon) = \exp[-i(eH/2c)(x - x')(y + y')] \times$$

$$\times \frac{eH}{c\cdot(2\pi)^2} \sum_n e^{-eH\rho^2/4c} L_n\left(\frac{eH}{2c}\rho^2\right) \int \frac{iae^{ip_z(z-z')}dp_z}{\varepsilon + p_0^2/2m^* - (n + 1/2)\omega^* - p_z^2/2m^* + i\delta(\varepsilon)} =$$

$$= \exp\{-i(eH/2c)(x - x')(y + y')\}\overline{G}(\mathbf{R}, \varepsilon), \quad (17)$$

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where $L_n(x)$ is a Laguerre polynomial. The formulas derived are then applied to study the influence of the Fermi-fluid effects upon the oscillation of the thermodynamic quantities of a metal in a magnetic field. The variation of the particle density N with the chemical potential μ is first investigated for $N = -iG_{\alpha\alpha}(x,x')_{x'\to x,\, t'\to t+0}$. In Fourier representation

$$\frac{\partial N}{\partial \mu} = \frac{i}{2\pi}\int d\omega \int G_{\alpha\gamma}(r, 1; \omega)\, G_{\gamma\alpha}(1, r; \omega)\, d^3 1 -$$
$$- \frac{1}{(2\pi)^8}\iint d\omega d\omega' \int d^3 s_1 d^3 s_2 d^3 s_3 d^3 s_4 d^3 1 G_{\alpha\alpha_1}(r, s_1; \omega)\, G_{\alpha_4\alpha}(s_4, r; \omega) \times$$
$$\times \Gamma_{\alpha_1\alpha_2,\alpha_3\alpha_4}(s_1, \omega; s_2, \omega'; s_3, \omega'; s_4, \omega)\, G_{\beta\alpha_2}(1, s_2; \omega')\, G_{\alpha_3\beta}(s_3, 1; \omega').$$

which can be transformed into

$$\frac{\partial N}{\partial \mu} = \frac{\sqrt{2m^*}m^*}{2\pi^3}\sqrt{\omega^*}\zeta\left(\frac{1}{2}, \frac{\Delta}{\omega^*}\right)\Phi^2,$$
$$\Phi = a\left\{1 + \frac{i}{2(2\pi)^4}\int \Gamma^{0k}_{\alpha\gamma,\,\gamma\alpha}(p_1, p_2)\, G^0(p_1, \omega)\, G^0(p_2, \omega)\, d^4 p\right\} \qquad (29)$$

For H = 0

$$\Phi = a\left(\frac{\partial G^{-1}}{\partial \mu}\right)_{p=p_0,\,\omega=0} = \frac{p_0}{m^*}\frac{dp_0}{d\mu}. \qquad (29')$$

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and

$$\frac{\partial N}{\partial \mu} = \frac{1}{\sqrt{2m^*}\,4\pi^2}\sqrt{\omega^*}\left(\frac{dp_0^2}{d\mu}\right)^2 \zeta\left(\frac{1}{2}, \frac{\Delta}{\omega^*}\right). \qquad (30)$$

hold. For the oscillating part of the thermodynamic potential Ω

$$\delta\Omega_{\text{осц}} = -\frac{4m^{*2}\omega^{*3/2}}{3\sqrt{2m^*}\,\pi^2}\zeta\left(-\frac{3}{2}, \frac{\Delta}{\omega^*}\right) = \frac{m^{*3/2}\omega^{*3/2}}{4\pi^2}\sum_1^\infty r^{-3/2}\cos\left(2\pi r\frac{\Delta}{\omega^*} - \frac{\pi}{4}\right),$$

is found, which agrees in full with the formula found by Lifshits and Kosevich. Finally the influence of electron spin on the oscillations, i.e. of the interaction between the magnetic field and magnetic moment of the spin, is studied. It is found that

$$\frac{\partial N}{\partial \mu} = \frac{\sqrt{\omega^*}}{8\pi^2\sqrt{2m^*}}\left(\frac{dp_0^2}{d\mu}\right)^2\left\{\zeta\left(\frac{1}{2}, \frac{\Delta}{\omega^*} + \frac{\xi H}{2\omega^*}\right) + \zeta\left(\frac{1}{2}, \frac{\Delta}{\omega^*} - \frac{\xi H}{2\omega^*}\right)\right\},$$

and for the oscillating part of the thermodynamic potential

$$\sigma\Omega_{\text{осц}} = -\frac{2m^{*2}\omega^{*3/2}}{3\pi^2\sqrt{2m^*}}\left\{\zeta\left(-\frac{3}{2}, \frac{\Delta + \xi H/2}{\omega^*}\right) + \zeta\left(-\frac{3}{2}, \frac{\Delta - \xi H/2}{\omega^*}\right)\right\}. \qquad (34)$$

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for the oscillating part of the magnetic moment

$$M_{\text{осц}} = -\frac{m^{*1/2}(\beta^* H)^{3/2}\mu}{2\pi^3\hbar^3 H}\sum_1^\infty \frac{(-1)^r}{r^{3/2}}\cos\left(\frac{\xi}{\beta^*}\pi r\right)\sin\left(\pi r\frac{cp_0^2}{e\hbar H}-\frac{\pi}{4}\right),$$

where $\beta^* = e\hbar/m^*c$, $c = \gamma T$ and $\xi/\beta^* = 4\pi^2\lambda/3\beta\beta^*\gamma$. The results show that the Lifshits-Kosevich procedure can be followed in order to determine oscillation periods. Deviation from the usual formulas occurs for the oscillation amplitudes and is due to the variation in the effective magneton excitation caused by electron interaction. Without taking account of spin susceptibility an expression for M_{osc} may be found from the usual representation of the electron system as a quasi-particle gas. This conclusion agrees with that of Luttinger. L. P. Pitayevskiy (ZhETF, 37, 1794, 1959) and A. A. Abrikosov and I. M. Khalatnikov (UFN, 66, 177, 1958) are mentioned, Academician L. D. Landau is thanked for discussions. There are 4 figures and 11 references: 8 Soviet and 3 non-Soviet. The latter read as follows: J. M. Luttinger. Phys. Rev. 121, 1251, 1961; E. Sondheimer, A. Wilson. Proc. Roy. Soc., A210, 173, 1951; Higher transcendental functions, 1, N.Y., 1953, p. 24.

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Quantum oscillations of the...

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems of the Academy of Sciences USSR)

SUBMITTED: May 31, 1961

Card 7/7

BYCHKOV, YU. A.

" A mehtod and device for automatic scanning of nuclear emulsions."

report submitted for the 1962 International Conference on Instrumentation for High Energy Physics at Cern, Geneva, 16-18 July 62.

SMOL'NIKOV, L.P. (Leningrad); BYCHKOV, Yu.A., (Leningrad); VOLKOV, Ye.F. (Leningrad)

Study of a third-order automatic control system optimum in respect to the sense of braking time with stabilized speed. Izv. AN SSSR. Tekh. kib. no.5:157-163 S-O '63. (MIRA 16:12)

BYCHKOV, Yu.A.; GOR'KOV, L.P.; DZYALOSHINSKIY, I.Ye.

One-dimensional superconductivity. Pis'. v red. Zhur. eksper. i teoret.fiz. 2 no.3:146-152 Ag '65.

(MIRA 18:12)

1. Institut fizicheskikh problem AN SSSR i Institut teoreticheskoy fiziki AN SSSR. Submitted June 15, 1965.

L 52961-65 EWT(1)/T/EWA(h) Pz-6/Peb IJP(c) AT

ACCESSION NR: AP5010514 UR/0056/65/048/004/1168/1173

AUTHOR: Bychkov, Yu. A.; Dykhne, A. M.

TITLE: Electric conductivity of semiconductors with a narrow energy band in a strong electric field

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 4, 1965, 1168-1173

TOPIC TAGS: semiconductor, electric conductivity, electric field dependence, energy band width, electron heating

ABSTRACT: After pointing out first that earlier investigations of the behavior of semiconductors in some electric fields have been limited to the case of quadratic carrier dispersion, and no account was taken of the finite width of the energy gap, the authors investigate the dependence of the conductivity of [illegible] the electric field, confining themselves to semiconductors with sufficiently narrow energy band. It is shown that allowance for the finite gap leads to an entirely different dependence of the current on the field intensity, namely that in sufficiently strong fields, when the effective temperature of the electrons becomes

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L 52961-65

ACCESSION NR: AP5010514

larger than the width of the allowed energy band, the current decreases with increasing electric field. When the effective temperature is much larger than the gap, the current is proportional to the reciprocal of the field, due to the heating of the electrons in the strong field. The question of a choice of a substance in which the described decrease of current with electric field can be observed experimentally calls for further study. Orig. art. has: 20 formulas.

ASSOCIATION: Institut khimicheskoy fiziki Akademii nauk SSSR Filial (Institute of Chemical Physics, Academy of Sciences AN SSSR Branch)

SUBMITTED: 14Nov64 ENCL: 00 SUB CODE: SS, EM

NR REF SOV: 000 OTHER: 001

Card 2/2

L 52960-65 EWT(1)/T/EWA(h) Pz-6/Peb IJP(c) AT

ACCESSION NR: AP5010515 UR/0056/65/048/004/1174/1178

AUTHOR: Bychkov, Yu. A.; Dykhne, A. M. 21

TITLE: Quantum electron levels in semiconductors in the presence of a strong electric field

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 4, 1965, 1174-1178

TOPIC TAGS: semiconductor, energy level, crystal field, band structure, level crossing

ABSTRACT: The energy levels of an electron moving in a periodic field of a crystal in the presence of a strong electric field are determined. The existence of a band structure, i.e., of maximum and minimum values of the kinetic energy of the electron, leads to a finite motion in ordinary space, and consequently to quantization of the energy levels. The analysis is restricted to the case when there exist two bands, the gap between which is considerably smaller than the energy gaps between these bands and the remaining bands, and the behavior of the system when the two band some close together is analyzed. It is shown that if allowance is made

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L 52960-65

ACCESSION NR: AP5010515

for transitions from one band to the other, the energy levels corresponding to the different bands can never cross. It is noted in conclusion that the results of the investigation can be applied to semiconductor theory. Orig. art. has: 2 formulas.

ASSOCIATION: Institut khimicheskoy fiziki Akademii nauk SSSR (Institute of Chemical Physics, Academy of Sciences SSSR)

SUBMITTED: 14Nov64 ENCL: 00 SUB CODE: SS

NR REF SOV: 001 OTHER: 001

Card 2/2

L 21809-66 EWT(1) IJP(c) AT

ACC NR: AP6012183 SOURCE CODE: UR/0386/66/003/008/0313/0316

AUTHOR: Bychkov, Yu. A.; Dykhne, A. M. 40 B

ORG: Institute of Theoretical Physics, Academy of Sciences, SSSR (Institut teoreticheskoy fiziki Akademii nauk SSSR)

TITLE: Electron spectrum in a one-dimensional system with randomly arranged scattering centers 27,

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 3, no. 8, 1966, 313-316

TOPIC TAGS: spectral energy distribution, electron energy level, electron scattering, quantum field theory, potential well

ABSTRACT: The authors consider the spectral density of the energy levels of an electron moving in a random field, using a one-dimensional model in which an exact solution can be obtained. In addition to the fact that the exact solution serves as a check on various approximations, the one-dimensional model has apparently a bearing on organic molecules. The model consists of identical arbitrarily arranged potentials in the form of δ functions, and an integral equation similar to that of F. J. Dyson (Phys. Rev. v. 92, 1331, 1953) is obtained for the characteristic func-

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L 21809-66
ACC NR: AP6012183

tion. The equation derived makes it possible to investigate the spectral density for a broad class of arrangements of the scattering centers, from periodic to completely random. The solution of this reduces to finding the solution of an integral equation, a detailed investigation of which will be reported elsewhere. One limiting case, which can lead under certain conditions to independent quantization in the potential wells between the scattering centers, with subsequent averaging over the distance between centers, is discussed briefly. Orig. art. has: 9 formulas.

SUB CODE: 20/ SUBM DATE: 17Feb66/ ORIG REF: 003/ OTH REF: 004

Card 2/2 PB

L 22249-66 EWT(1) IJP(c) GG

ACC NR: AP6010996 SOURCE CODE: UR/0056/66/050/003/0738/0758

AUTHOR: Bychkov, Yu. A.; Gor'kov, L. P.; Dzyaloshinskiy, I. Ye.

ORG: Institute of Theoretical Physics, Academy of Sciences, SSSR (Institut teoreticheskoy fiziki Akademii nauk SSSR)

51
B

TITLE: The possibility of effects similar to superconductivity in a one-dimensional system

21

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 3, 1966, 738-758

TOPIC TAGS: superconductivity, superconductor, Fermi particle, BCS theory, electron pair

ABSTRACT: It is shown that the Fermi state of a one-dimensional system is unstable relative to an arbitrarily weak attraction between the particles. In distinction to the three-dimensional case, it is the particle quartets near the Fermi surface which exhibit specific properties similar to those of the electron pairs in the BCS theory. Instability changes the ground state in such a way that a spectrum gap appears and the structure period doubles. However, the new ground state is capable of passing a current without energy dissipation. Interaction with the lattice leads to the appearance of an effective interaction between the electrons. If the effective interaction be-

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L 22249-66

ACC NR: AP6010996

between the electrons. If the effective interaction is repulsive (but weak), the system remains in the metallic state of all temperatures. The problem of fluctuations is discussed. [CS]

SUB CODE: 20/ SUBM DATE: 06Oct65/ ORIG REF: 006/ OTH REF: 005/

Card 2/2 nst

ACC NR: AP7003233 SOURCE CODE: UR/0056/66/051/006/1914/1917

AUTHOR: Bychkov, Yu. A.; Dykhne, A. M.

ORG: Institute of Theoretical Physics, Academy of Sciences, SSSR (Institut teoreticheskoy fiziki Akademii nauk SSSR)

TITLE: Electric conductivity of one-dimensional systems

SOURCE: Zh eksper i teor fiz, v. 51, no. 6, 1966, 1914-1917

TOPIC TAGS: electric conductivity, particle scattering, distribution function, Green function, integral equation, dimension analysis

ABSTRACT: The one-dimensional model previously employed by the authors (ZhETF Pis'ma v. 3, 313, 1966) is used to calculate rigorously the electric conductivity as a function of the frequency, in a one-dimensional system in which the particles do not interact with one another but are scattered by rendomly distributed impurities whose potential is taken in the form of δ functions. The averaging over an ensemble characterized by a distribution function for the distances between the neighboring scatterers is done in explicit form. An integral equation is obtained such that the electric conductivity can be expressed in terms of its solution in quadratures. The equation obtained makes it possible to average also other quantities, particularly the Green's function of a particle. Orig. art. has: 11 formulas.

SUB CODE: 20/12/ SUBM DATE: 12Jul66/ ORIG REF: 001/ OTH REF: 001

Card 1/1

ACC NR: AP7003235 SOURCE CODE: UR/0056/66/051/006/1923/1929

AUTHOR: Bychkov, Yu. A.; Dykhne, A. M.

ORG: Institute of Theoretical Physics, Academy of Sciences, SSSR (Institut teoreticheskoy fiziki Akademii nauk SSSR)

TITLE: Impurity band in the one-dimensional model

SOURCE: Zh eksper i teor fiz, v. 51, no. 6, 1966, 1923-1929

TOPIC TAGS: electron energy, energy spectrum, impurity level, impurity center, impurity band, dimension analysis

ABSTRACT: The authors determine the energy spectrum of an electron in the vicinity of an impurity level corresponding to one isolated center. A one-dimensional model is considered, wherein the electron moves in a field of randomly located attracting δ-like centers, which are assumed to have a Poisson distribution. The spectrum is determined by solving a differential equation derived by H. L. Frisch and I. C. Lloyd (Phys. Rev. v. 120, 1175, 1960), from which expressions are also derived for the integral density and for the spectral density. The results show that the impurity band is asymmetrical and has an asymmetrical integrable singularity. A measure of the asymmetry of the impurity band is the number of levels with energy lower than that corresponding to a single center. Orig. art. has: 40 formulas.

SUB CODE: 20/ SUBM DATE: 15Jul66/ ORIG REF: 001/ OTH REF: 001

Card 1/1

ACC NR: AP7000285 (A) SOURCE CODE: UR/0143/66/000/011/0090/0093

AUTHORS: Smol'nikov, L. P. (Candidate of technical sciences, Docent); Sofronov, V. G. (Engineer); Volkov, Ye. F. (Engineer); Bychkov, Yu. A. (Engineer)

ORG: Leningrad Electrical Engineering Institute im. V. I. Ul'yanov (Lenin) (Leningradskiy elektrotekhnicheskiy institut)

TITLE: An optimal digital servo system

SOURCE: IVUZ. Energetika, no. 11, 1966, 90-93

TOPIC TAGS: servosystem, optimal automatic control, rolling mill, digital system, electric motor, trigger circuit, magnetic amplifier, electronic feedback, second order differential equation / DP-42 electric motor

ABSTRACT: A brief description of a digital servo system for automatic control of the clamping device on a sheet rolling mill is presented. The servo system (see Fig. 1) uses an electromagnetic shaft position-to-digital converter (SDC) as the pickup of the true position of the upper roller B. An arithmetic device (AD) continuously calculates the difference $\varepsilon = A - B$ between the assigned position of the upper rollers A and B. The positive or negative difference (obtained in binary code) is converted to a voltage proportional to this difference by code-to-voltage converters (CVC) Near-to-optimum response speed of the system can be achieved by using strong linear motor-speed feedback. An experimental study performed directly on a mill

Card 1/2 UDC: 62—503.53

ACC NR: AP7000285

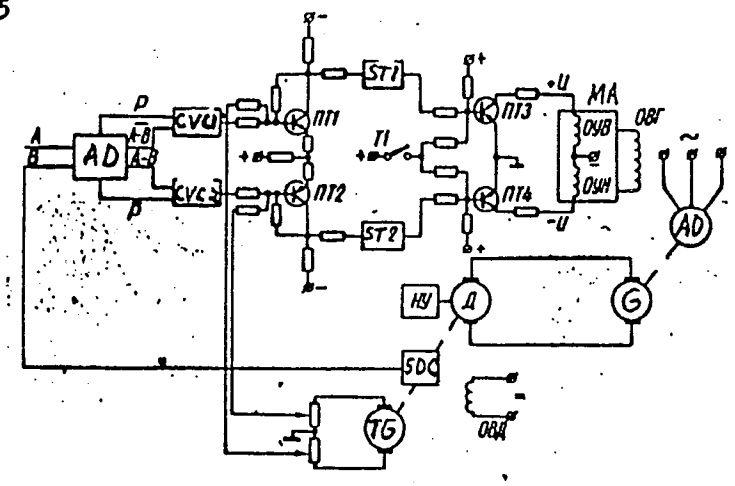
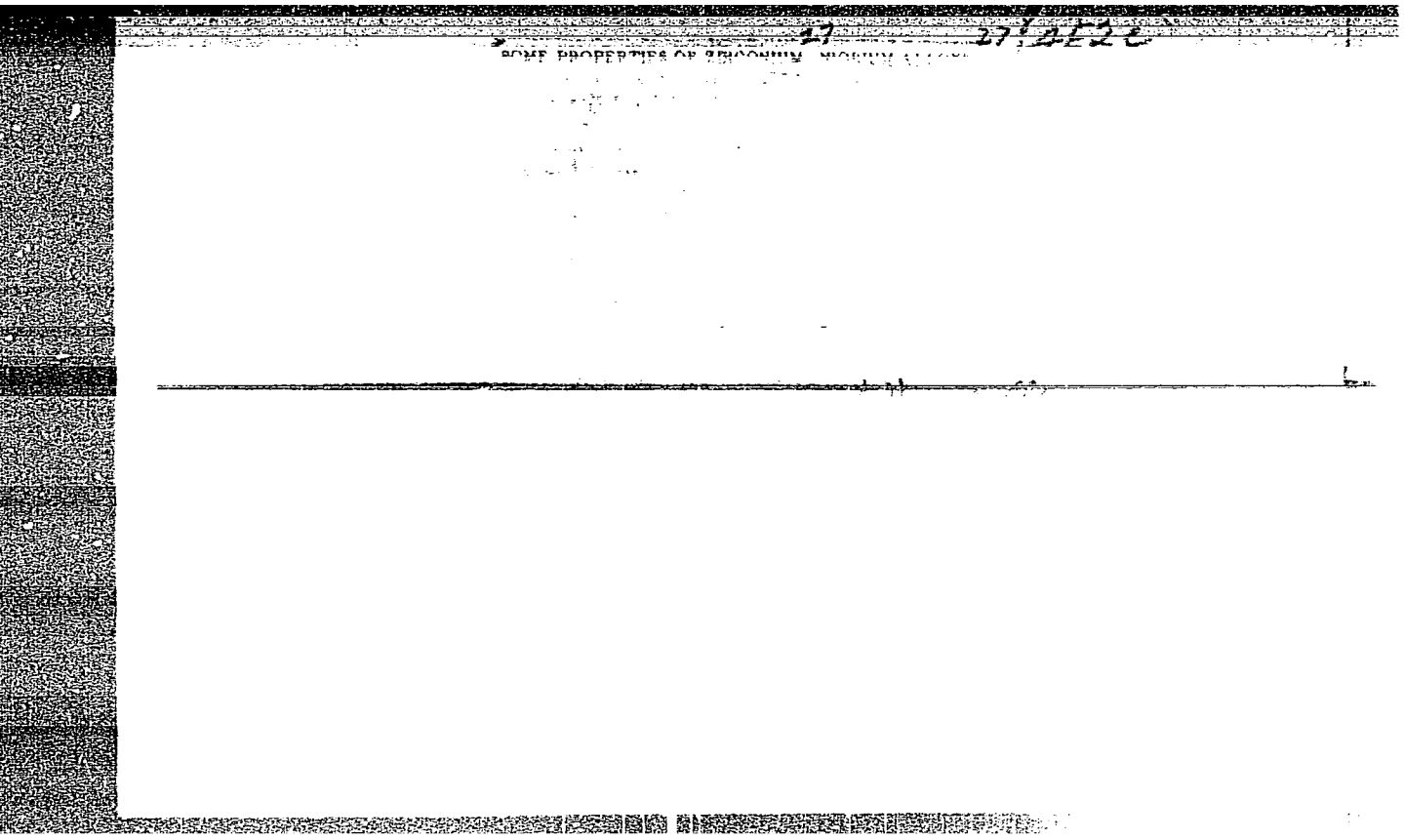


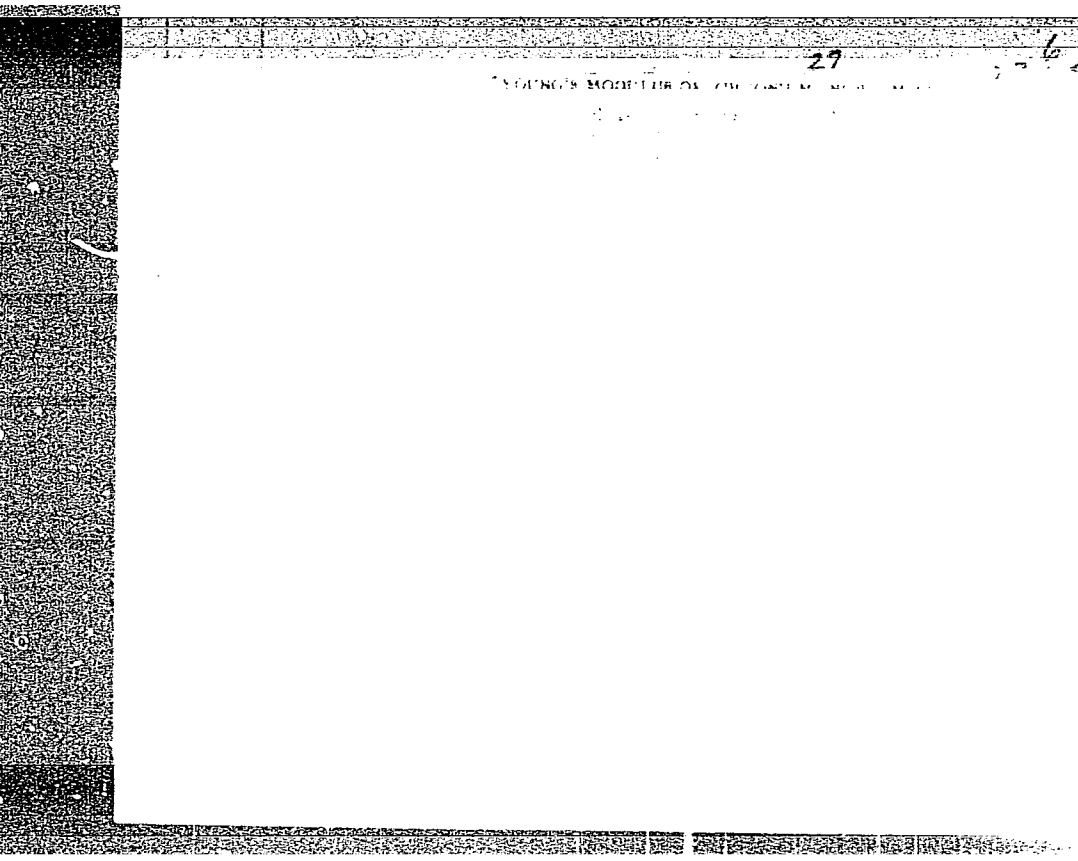
Fig. 1. Circuit of digital servo system: ST - Schmitt trigger circuit; MA - magnetic amplifier; M - motor; G - generators; TG - tachogenerator

showed that the realization of near-to-optimum control ensured the required accuracy of stopping the electric drive without using "creeping" speeds in various movements of the upper roller. The dynamics of the electric-drive system is approximately described by a second-order linear differential equation. The time constant is 1.2 sec. Orig. art. has: 1 diagram and 1 graph.

SUB CODE: 09,13/SUBM DATE: 26Apr65/ ORIG REF: 003

Card 2/2





SOV/137-58-11-23716
Translation from: Referativnyy zhurnal. Metallurgiya, 1958, Nr 11, p 263 (USSR)

AUTHORS: Sirota, N. N., Bychkov, Yu. F.

TITLE: Measuring the Longitudinal Modulus of Elasticity at High Temperatures in a Vacuum (Izmereniye prodol'nogo modulya uprugosti pri vysokikh temperaturakh v vakuume)

PERIODICAL: Sb. nauchn. tr. Mosk. in-t tsvetn. met. i zolota, Nauchno-tekhn. o-vo tsvetn. metallurgii, 1957, Nr 30, pp 254-267

ABSTRACT: An apparatus is described for measuring the modulus of normal elasticity E in a vacuum at temperatures up to 1000°C. The magnitude of the E of a material was calculated according to the measured values of the natural frequencies of the transverse oscillations of a cylindrical specimen (S). The general arrangement of the apparatus is given. The electric oscillations are transferred from a 3G-2A sonic-frequency generator to a piezoelectric transducer which transforms them into mechanical oscillations of the same frequency. The horizontally suspended S is connected to the oscillating needle of the transducer by means of a suspension wire. The natural oscillations excited in the S are picked up by a detector, consisting of a second piezoelectric

Measuring the Longitudinal Modulus of Elasticity at High Temperatures (cont.)

adapter with the S suspended from its needle. Adapters with Rochelle salt crystals are used as the transducer and the receiver. The transducers are mounted in a special quartz apparatus which makes it possible to reproduce the measurements of natural frequencies in a vacuum and which is placed in a dismountable electric resistance furnace. The temperature of the S is measured by a Pt/Pt-Rh thermocouple introduced into the quartz apparatus through a Mo-glass probe into which the thermocouple is welded. The apparatus is evacuated to 10^{-4} mm Hg. The total error of measurements constitutes ~3%. An analysis of the effect of the size of S on the magnitude of E is given, also the experimental results obtained with an alloy of Fe with 16% Ni.

L. G.

Card 2/2

SOV/137-58-11-23615

Translation from: Referativnyy zhurnal. Metallurgiya, 1958, Nr 11, p 249 (USSR)

AUTHORS: Bychkov, Yu. F., Rozanov, A. N., Skorov, D. M.

TITLE: Elastic Properties and Hardness of Zirconium-niobium Alloys at Elevated Temperatures (Uprugiye svoystva i tverdost' splavov tsirkoniya s niobiyem pri povyshennykh temperaturakh)

PERIODICAL: Sb. nauchn. tr. Mosk. in-t tsvetn. met. i zolota, Nauchnotekhn. o-vo tsvetn. metallurgii, 1957, Nr 30, pp 268-282

ABSTRACT: A Zr-Nb phase diagram is plotted. The mechanical and certain physical properties of alloys (A) thereof are investigated relative to temperature and time. The A are made in an arc furnace with a W electrode in an Ar atmosphere. The charge employed is Zr iodide containing 1.5% Hf also Nb foil with 1% Ta added. After repeated remelting, contamination with W is <0.1%. A with less than 20% Nb are forged at 800-500°C, while samples with greater Nb content are made from cast rods. The phase diagram plotted is identical in appearance with that of Rogers and Atkins (RZhMet. 1956, Nr 7, abstract 6709), but the transformation temperatures are somewhat lower owing to the difference in the chemical composition

Card 1/2

Elastic Properties and Hardness of Zirconium-niobium Alloys (cont.)

of the starting materials. The graph of H_B versus composition presents a flat maximum (260 kg/mm^2) at 50-80% Nb and a peak of diffusionless transformation at 7.5% Nb, which disappears upon slow cooling of the A from 650°. Quenched A are noticeably hardened by aging. As Nb content increases there is a rise in H_B at elevated temperatures, particularly at >20% Nb. Upon heating from 20° to 750° the hardness of A containing not less than 50% Nb is reduced by 20-30%, while when Nb content is about 7% the decline is by 95 to 97%. A study of the influence of A contents upon ρ makes it possible to clarify the dependence of E upon composition after various heat treatments. It is found that the strength of the interatomic bond in quenched Zr-Nb solid solutions is considerably less than the strength of the bond in pure Zr and in solid solutions with small additions of Nb. Distortion in the crystal lattice as the result of alloying and heat treatment results in a sharp change in E and ρ. Upon heating from 20 to 900° the value of E drops by 59% for Zr and only by 6.6% for A containing 75% Nb. At 900° all A have a substantially higher E than does pure Zr. Thus in Nb-rich A the properties characterizing heat resistance and the strength of the interatomic bond change considerably less than the properties of Zr-rich A in the same temperature intervals.

G. T.

Card 2/2

AUTHOR: BYCHKOV,YU.F., ROZANOV,A.N., SKOROV,D.M. PA - 2258

TITLE: Some Properties of Zirconium-Niobium Alloys. (Nekotoryye svoystva splavov tsirkoniya s niobiyem, Russian).

PERIODICAL: Atomnaia Energiia, 1957, Vol 2, Nr 2, pp 146 - 151 (U.S.S.R.)
Received: 3 / 1957 Reviewed: 5 / 1957

ABSTRACT: The samples serving for the study and mechanical testing of the Zr-Nb system were produced from zirconium-iodide bars with ~1,5% hafnium and of a niobium foil with a content of ~1% tantalium in an electric arc furnace with copper bottom and tungsten electrodes. The samples were amalgamated in a purified arcon atmosphere. Metallographic and radiographic investigations were carried out by means of the usual methods. Solidus- and liquidus lines were determined in a vacuum furnace.

The state diagram of the zirconium-niobium system: In the case of samples which were chilled after homogeneigation at 1250° C and in the case of cast samples a continuous series of solutions with a space-centered cubic lattice developes at high temperatures. The alloys with a high content of niobium decompose when being annealed, on which occasion all lines in the radiogram separate into two parts. The solidus- amd liquidus curves obtained from initial and total smelting have a minimum at 25 - 28% niobium and 1600°C.

PA - 2258

Some Properties of Zirconium-Niobium Alloys.

The mechanic properties of the Alloys: The dependence of the limit of stability as well as of the relative expansion on the niobium content of the alloys annealed at 700° C is shown in a diagram. The alloy with 7,5% niobium has the maximum stability limit(75 kg/mm^2) and the minimum relative expansion (6%). All other alloys have a relatively great expansion, i.e. it is rather plastic. The alloys with from 5 to 10% niobium are brittle in cast state as well as after chilling (from high temperatures). The dependence of hardness on composition is similar to the analogous dependence of the stability limit. The dependence of the hardness of the chilled as well as of the cast alloys on composition can be expressed by a curve with a flat maximum at 50 - 80% Nb; it is characteristic of a continuous number of solid solutions. This curve is superposed by a peak that is due to a diffusionless transformation of the cubic ß-phase into the needle-shaped ∝-phase. Next, the strength of the alloys at high temperatures is discussed; it is considerably lower with alloys that have a high content of zirconium than with alloys on a niobium basis. The greater the content of niobium in the alloys is, the lower is the alloy's power of resistance against oxidation. (7 illustrations).

Card 2/3

PA - 2258

Some Properties of Zirconium-Niobium Alloys.

ASSOCIATION: Not given.
PRESENTED BY:
SUBMITTED 17.5.1957
AVAILABLE: Library of Congress.

Card 3/3

AUTHOR: BYCHKOV,YU.F., ROZANOV,A.N., SKOROV,D.M. PA - 2259

TITLE: Young's Modulus of the Alloys of Zirconium with Niobium (Modul' normal'noy uprugosti splavov tsirkoniya s niobiyem, Russian).

PERIODICAL: Atomnaia Energiia, 1957, Vol 2, Nr 2, pp 152 - 156 (U.S.S.R.).
Received: 3 / 1957 Reviewed: 5 / 1957

ABSTRACT: The present work describes measuring results ot this modulus in the vacuum at temperatures of up to 950° C and at room temperature after different forms of heat treatment.

At first the device for measuring this modulus is described by means of a drawing. Young's modulus was determined from the eigen-frequencies of bending flexural vibrations of cylindrical samples of a length of about 80 mm and a diameter of 4-6 mm. A normal telephone served as oscillation generator. The samples were produced in an electric arc furnace fitted out with a special device for casting rods in an argon atmosphere. The production of homogeneous viscous melts with a high content of niobium is discussed. For the purpose of investigating the influence exercised by heat treatment on Young's modulus, samples were annealed in evacuated quartz ampules in electric furnaces fitted out with heat regulators.

Card 1/3 The measured Young's modula of tempered and annealed alloys as

Young's Modula of the Alloys of Zirconium with Niobium.

well as electric resistances of the tempered alloys are shown in form of diagrams. In the case of alloys tempered from 1100° C in water, the curves (Young's modulus to composition) and (electric resistance to composition) are mirrorimage-like assigned towards each other. The modification of the modulus and electric resistance are caused by disportions of the chrystal lattice. The other factors exercise but little influence. The tempered alloys of niobium and zirconium are in a metastable state. Young's modulus of alloys shows a particularly marked increase in the vicinity of the minimum value of the modulus of the tempered samples. In a table it is shown in what manner Young's modulus of alloys with a different content of niobium decreases as a result of heating of these alloys from roon temperature up to 900°C.

In conclusion the investigation of the transformations in zirconium-niobium alloys by means of the thermoelastic method is discussed in short. Thus, it is shown that an eutectoid transformation at 560° C in an alloy containing 10 % Nb occurs visibly in the case of heating. The creation of a new cubic ß-phase in the case of heating the alloy above eutectoid temperature decreases Young's modulus rather sharply. Inverse transformation, decay of the ß-phase into a hexagonal α -phase and into a ß-phase

PA - 2259

Young's Modulus of the Alloys of Zirconium with Niobium.

of a different composition causes Young's modulus to increase.
(3 illustrations and 1 table.)

ASSOCIATION: Not given.
PRESENTED BY:
SUBMITTED: 19.9.1956
AVAILABLE: Library of Congress.

Card 3/3

BYCHKOV, Yu. F., Cand of Tech Sci — (diss) "Investigation of the Alloys of Zirconium and Niobium," Moscow, 1959, 11 pp (Moscow Engineering Physics Institute) (KL, 5-60, 125)

BYCHKOV, YU.F.

PHASE I BOOK EXPLOITATION SOV/3559

Akademiya nauk SSSR. Institut metallurgii. Nauchnyy sovet po probleme zharoprochnykh splavov

Issledovaniya po zharoprochnym splavam, t. 5 (Investigations of Heat-Resistant Alloys, Vol 5) Moscow, Izd-vo AN SSSR, 1959. 423 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V.A. Klimov; Tech. Ed.: I.F. Kuz'min; Editorial Board: I.P. Bardin, Academician, G.V. Kurdyumov, Academician, N.V. Ageyev, Corresponding Member, USSR Academy of Sciences (Resp. Ed.), I.A. Oding, I.M. Pavlov, and I.F. Zudin, Candidate of Technical Sciences.

PURPOSE: This book is intended for metallurgical engineers, research workers in metallurgy, and may also be of interest to students of advanced courses in metallurgy.

COVERAGE: This book, consisting of a number of papers, deals with the properties of heat-resisting metals and alloys. Each of the papers is devoted to the study of the factors which affect the properties and behavior of metals. The effects of various elements such as Cr, Mo, and W on the heat-resisting properties of various alloys are studied. Deformability and workability of certain metals as related to the thermal conditions are the object of another study described. The problems of hydrogen embrittlement, diffusion and the deposition of ceramic coatings on metal surfaces by means of electrophoresis are examined. One paper describes the apparatus and methods used for growing monocrystals of metals. Boron-base metals are critically examined and evaluated. Results are given of studies of interatomic bonds and the behavior of atoms in metal. Tests of turbine and compressor blades are described. No personalities are mentioned. References accompany most of the articles.

4/5

32801
S/137/61/000/012/121/149
A006/A101

18.1272 1521 1418

AUTHORS: Bychkov, Yu.F., Rozanov, A.N., Skorov, D.M.

TITLE: Zirconium-niobium phase diagram

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 12, 1961, 23, abstract 12Zh168 (V sb. "Metallurgiya i metalloved. chist. metallov", no. 1, Moscow, 1959, 179 - 191)

TEXT: The X-ray, thermal, dilatometric, thermal-elastic and metallographic methods were employed to study transformations and to plot a phase diagram of the Zr-Nb system. The alloys investigated were melted in an arc furnace in argon atmosphere from a Nb-strip of iodide Zr rods of 99.7% purity. After 3-5 fold remelting the ingots were forged at 800-600°C and subjected to heat treatment. It was established that in the Zr-Nb system at high temperatures a continuous series of solid solutions is formed between β-Zr and Nb with a minimum on the solidus curve at 1,600°C and 30% Nb. At 560°C, the eutectoid decomposition of β-solid solutions takes place. The eutectoid point corresponds to 12% Nb. During the quenching of alloys containing up to 15% Nb, the β-solution is

Card 1/2

Zirconium-niobium phase diagram

partially or fully transformed into acicular or reticular martensite-like structure. In alloys with 15% and more Nb, a body centered cubic β-phase appears during quenching from high temperatures.

A. Belinkiy

[Abstracter's note: Complete translation]

Card 2/2

32617
S/137/61/000/011/075/123
A060/A101

18 1272

AUTHORS: Bychkov, Yu.F., Rozanov, A.N.

TITLE: Change in the physical characteristics under decomposition of the β-phase in the alloy of zirconium with 15% niobium

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 11, 1961, 35, abstract 11Zh212 (V sb. "Metallurgiya i metalloved. chist. metallov.", no. I, Moscow, 1959, 224 - 230)

TEXT: The aging process of the alloy of Zr with 15% Nb water-hardened at 1,100°C and having a β-phase structure was investigated by the measurement of E, ρ, the thermal expansion, and the hardness. Under heating of the alloy up to 350°C the E is lowered somewhat, and then increases, attaining a maximum at 520°C and then decreases again with further heating up to 900°C. In the process of cooling the E increases monotonously, attaining higher values at room temperature than in the hardened state. The described pattern is explained by the formation during heating of the solid β solution of a new phase with high E. The maximum on the curve of E vs temperature dependence is explained by the formation of the greatest quantity of the new phase at 500°C. The new phase has a lower specific volume.

Card 1/2

Change in the physical characteristics ...

The ρ of the alloy decreases under heating up to 300°C and then increases, attaining a maximum also at 500°C. Under cooling, it decreases monotonously. Under heating up to 400°C the hardness drops monotonously, and at 400-600°C there is a maximum of the hardness, as result of the formation of the transition phase. Under isothermal heating the hardness maximum is observed at somewhat lower temperatures than under continuous heating. Thus, under heating the alloy of Zr with 15% Nb, a transition phase is formed at 350-550°C, possessing high E, increased hardness and ρ, and a low specific volume.

M. Shapiro

[Abstracter's note: Complete translation]

Card 2/2

BYCHKOV, Yu.F.; KLIMOV, A.F.; ROZANOV, A.N.; SKOROV, D.M.

Effect of alloying on the longitudinal elasticity modulus of zirconium. Met.i metalloved.chist.met. no.1:231-242 '59.
(MIRA 12:10)

(Zirconium alloys) (Elasticity)

S/137/61/000/005/056/060
A006/A106

188300

AUTHORS: Byohkov, Yu. F.; Rozanov, A. N.; Skorov, D. M., and Cheburkov, V.I.

TITLE: Corrosion resistance of Yal-T (Yal-T) steel in lithium with oxygen and nitrogen admixture

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 5, 1961, 60, abstract 5I453 (V sb.: "Metallurgiya i metallovedeniye chistykh metallov", no. 2, Moscow, Atomizdat, 1960, 78-92)

TEXT: The authors studied changes in the microstructure and mechanical properties of Fe, Ni, and Cr-Ni- steel grade "Yal-T" as a result of the effect of distilled Li and Li containing 1-2 weight % O or N. They investigated also changes in the chemical composition of Li due to the corrosion of the enumerated substances contained in it.

Ye. L.

[Abstracter's note: Complete translation]

Card 1/1

28063 S/137/61/000/004/036/039
A056/A101

18.3100

AUTHORS: Bychkov, Yu. F., Rozanov, A. N., Gromov, B. I., Cherbukov, V. I.

TITLE: Laboratory installation for vacuum distillation of lithium with the filling of the crucible

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 4, 1961, 50, abstract 4I399 (V sb. "Metallurgiya i metallovedeniye chistykh metallov", no. 2, M., Atomizdat, 1960, 171-177)

TEXT: The schematic diagram of a distiller for obtaining Li is described. Its operating conditions are as follows: The vaporization temperature of electrolysis crude lithium is such, that Li itself and the more volatile components (K and Na) are sublimated, while the less volatile (Fe and Ni) remain in the evaporator; the condenser temperature is fixed so that Li, precipitating at liquid state, should flow into the crucible, while the more volatile components should vaporize and precipitate only in the colder parts of the distiller. The processing is effected under a pressure of 10^{-4} mm Hg. The purity of Li attains 99.96%.

I. N.

[Abstracter's note: Complete translation]

Card 1/1

BYCHKOV, Yu.F.; ROZANOV, A.N.; ROZANOVA, V.B.

Determining the solubility of metalls in lithium. Met. i metalloved. chist. met. no. 2:178-188 '60. (MIRA 13:12)
(Lithium--Thermal properties) (Solubility)

80286
S/170/60/003/04/15/027
B007/B102

18.1200

AUTHORS: Bychkov, Yu. F., Maskalets, V. N., Rozanov, A. N.

TITLE: Characteristic Features in the Beta Phase Decay in Zirconium Alloys

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1960, Vol. 3, No. 4, pp. 95 - 98

TEXT: The data known from publications and obtained by the authors indicate a relation between stability of the beta-phase in zirconium alloys and concentration of the outer electrons. It is shown that the degree of stability of the beta-phase and the composition of the alloys, in which the omega-phase is formed in hardening, depends to a considerable extent on the concentration of the outer electrons in the alloy. For this reason chromium and molybdenum must have a stabilizing effect on the beta-phase, twice as strong as that of niobium or vanadium. In the present case zirconium alloys with 15 % by weight of Nb and such with 10 % by weight of Mo were investigated. The experiment is briefly described. It showed that the dependence of the physical properties of hardened zirconium alloys with 15 % Nb and of such with 10 % Mo on the temperature of heating is not monotonic. The experimental data concerning the alloy with 10 % Mo are given in Fig. 1; the data concerning

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Characteristic Features in the Beta Phase Decay in Zirconium Alloys

the alloy with 15 % Nb are given in the paper of Ref. 2. Fig. 2 shows the change of the modulus of elasticity E, of the electric resistivity ρ and of the Brinell hardness in isothermic drawing at 300, 400 and 500°C of the zirconium alloys with 15 % Nb. Fig. 3 shows the same for a zirconium alloy with 10 % Mo. The change of the alloy properties in drawing, the increase of the electric resistance by 10 %, of the modulus of elasticity by 65 -75 %, of hardness by twice its amount, is somehow connected with the character of the omega transition phase and with the change of the properties of the matrix. The high values of the modulus of elasticity (more than 10 000 kg/mm^2) and probably also the decrease in volume of the alloy in omega-phase formation are indicative of intermetallic properties of the omega-phase insofar as beta-phase lattice tensions (arising when the new phase is forming) may lead to an increase in electric resistance and in hardness, but not to an increase of the modulus of elasticity. A formula for calculating the activation energy of the formation of the omega-phase is written down on the assumption that a certain quantity and degree of separation of the omega-phase corresponds to the electric resistivity maxima at 300 and 400°C, and that the omega-phase formation depends exponentially on temperature. The results obtained in the calculation of the activation energy show that the omega-phase formation

Card 2/3

80286

Characteristic Features in the Beta Phase Decay in Zirconium Alloys

S/170/60/003/04/15/027
B007/B102

in drawing is limited by the mobility of the elements in the alloy. There are 3 figures, and 7 references, 4 of which are Soviet.

Card 3/3

S/755/61/000/003/009/027

AUTHORS: Bychkov, Yu. F., Vlasov, V. V., Rozanov, A. N.

TITLE: Some properties of ternary β solid solutions of zirconium with niobium and molybdenum.

SOURCE: Moscow. Inzhenerno-fizicheskiy institut. Metallurgiya i metallovedeniye chistykh metallov. no.3. 1961, 82-95.

TEXT: The paper provides a literature survey and a report on an experimental investigation on certain alloys of the Zr-Nb-Mo which exhibit a highly stable β solid solution and which have good over-all mechanical properties, good heat resistance, forgeability, and refractoriness. The literature survey is largely based on "The metallurgy of zirconium" (B. Lustman, F. Kerze, Jr., eds., McGraw-Hill, 1955; Foreign Lit. Publ. House, Moscow, 1959), the contribution of O. Ivanov, and V. K. Grigorovich at the 2d Internat'l Conf. on the Peaceful Uses of Atomic Energy, Geneva, 1958, a paper by Yu. F. Bychkov, et al., (Atomnaya energiya, v.2, no.2, 1957, 146), Domogala, R. F., et al. (J. Metals, v.9, no.10, sec. II, 1957, 1191-6). The especial objective of the present investigation was the study of the ternary β solid solutions of Zr with Nb and Mo in that region of the phase diagram in which such solid solutions could be expected to exist to form refractory alloys.

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The partial replacement of Nb by Mo is of especial interest since a given Mo additio is twice as effective in stabilizing the β phase (O. Ivanov, loc. cit.). The preparatio of the alloys in an arc furnace in an atmosphere of chemically pure Ar, purified by a Zr getter melt, is described; the alloy composition is summarized in a half-page table. Corrosion tests were made on 10-mm diam, 6-mm high, cylindrical speci- mens prepared from 8-10-time remelted 20-25-g powder batches, which were surface-ground and acetone-washed. Mechanical tests were performed on 80-90-m long rods weighing 65-70 g; elongation-test specimens were 3 mm diam, 20 mm long. Heating for hardness tests was performed at 5°C/min, with 3-min hold at tes T and a one-minute diamond-pyramid impression under a 1-kg load. The m.p. was measured pyrometrically by observing the interior of a small aperture in the speci- me n up to the moment of the filling-in of the aperture. The modulus of normal elasticity was measured by means of the flexural resonance frequency of a freely suspended cast rod on the vacuum equipment described by the senior author, et al. (in Atomnaya energiya, v.2, no.2, 1957, 152) an equipment which was also employed for resistance measurements by means of a twin bridged-T type Thomson network. A vacuum dilatometer was used in the elongation measurements. The refractori- ness of the various alloys was tested by 125-hr air oxidation at 600°C. The most refractory of the alloys tested was found to be the alloy with 15% Nb and 10% Mo. Small (0.1-0.5%) additions of Fe, Ni, Cu, and Ag increased the refractoriness of all

Zr-Nb-Mo alloys substantially. The kinetics of the oxidation comprise a low-rate first stage, in which a black, tightly-adhering, oxide film is formed, and a more steeply rising second stage, in which a grey oxide forms on the edges of the specimens. The black film on the heat-resistant alloys was studied by X-ray diffraction and was found to contain not only ZrO_2 (as on pure Zr), but a small quantity of compounds such as $Nb_2O_5 \cdot 6ZrO_2$ (cf. Spitsyn, V.I., et al., Akad. n. SSSR. Dokl., v.131, no.4, 1960, 858, and Klopp, W.D., et al., Report no.712 at the 2d Internat'l Conf. on the Peaceful Uses of Atomic Energy, Geneva, 1958). The mechanical tests (H_{RC} of a 50% deformed specimen versus T upon 30-min hold) show that the β solid solution in the optimal alloy has significant stability, but is not thermodynamically stable and decomposes at high T with the formation of a second phase. The heat resistance of the alloys was tested by H_V and stress-rupture tests at various T. The H_V of most of the alloys dropped rapidly beyond 500°C (except for the 750°C break of the 48% Ni, 3% Ti alloy recommended in Nucl. Sci. Abstracts, v.28, no.2232, 1959). Alloys of the 15Nb-10Mo type have about the same H_V at 680°C as Zircalloy-2 has at 300°C. The high heat resistance of β solid solutions of Zr is in consonance with the findings set forth in D. Douglass's brief communication in Reactor Core Materials, Aug. 1960, 44. The physical properties of the 15Nb-10 Mo alloy were further investigated. Its m.p. is 1,640°C; with the addition of 0.5% each

of Fe, Cu, Ni, and Ag its m.p. is 1,525°C. E at room T is 8,600 kg/mm^2, i.e., less than that of Zr (10,800 kg/mm^2), but at 900°C the E of the alloy is 6,750 against that of Zr which is 3,420 kg/mm^2. The linear expansion coefficient is small ($6.5 \cdot 10^{-6}$/°C) and almost T-independent in the 100-800°C range. The calculated heat-conductivity coefficient at 500°C of the alloy is somewhat higher than that of Zr (0.2 against 0.16 w/cm·°C. There are 7 figures, 3 tables, and 14 references (6 Russian-language Soviet, 2 Russian-language translations of English-language originals, and 6 English-language).

ASSOCIATION: MIFI (Moscow Engineering Physics Institute).

ROZANOV, A.N.; BYCHKOV, Yu.F.

[Methods for constructing diagrams of state for alloys used in nuclear power engineering] Metody postroeniia diagramm sostoianiia splavov primeniaemykh v iadernoi energetike. Moskva, 1962. 49 p. (MIRA 18:3)

1. Moscow. Inzhenerno-fizicheskiy institut.

BYCHKOV, Yu.F.; IVANOV, V.A.; ROZANOV, A.N.

Formation of scale with a structure of $6ZrO_2 \cdot Nb_2O_5$ on zirconium-niobium alloys. Met. i metalloved. chist. met. no. 4:47-57 '63. (MIRA 17:5)